

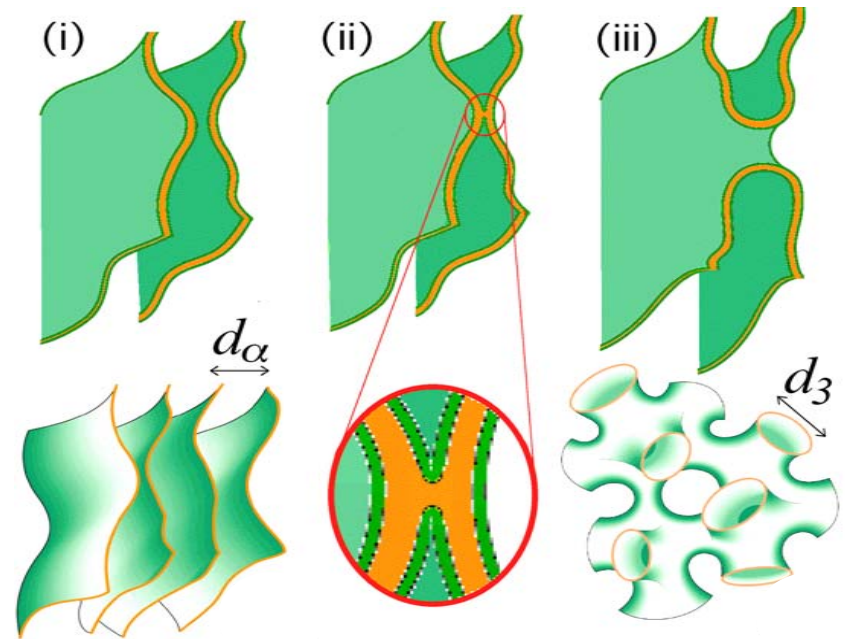
Energetics of Membrane Fusion

L. Porcar^{1,2}, W.A. Hamilton³, P.D. Butler^{2,3}, and G.G. Warr⁴

¹U. Maryland, ²NIST/CHRNA, ³ORNL, ⁴U. Sydney, Australia, [DMR-9986442](#)

The fusion of membranes formed by lipid or surfactant bilayers is ubiquitous in both surfactant chemistry and cell biology. Its significance is widely recognized in living systems where membrane fusion allows controlled transport and mixing in cells.

We have demonstrated a novel method for determining the energy barrier for membrane fusion in a surfactant system that may have direct application to biological membrane fusion. Membranes are prepared in a stacked, parallel arrangement by steady shear, which relaxes into a multiply-connected sponge-like equilibrium structure on cessation of shear. The sponge is formed by the fusion of adjacent bilayers to create an isotropic network of channels. By comparing this structural relaxation time, derived from time-resolved small-angle neutron scattering measurements, to that for diffusive membrane contacts obtained from dynamic light scattering, the energy barrier to membrane fusion has been determined as a function of membrane concentration and composition.



Stages in the relaxation of shear-aligned surfactant bilayers, which proceeds via bilayer fusion and passage formation, to the equilibrium sponge phase.

L. Porcar *et al.*, *Langmuir* **19**, 10779 (2003);
PRL (in press 2004).